

WHAT IS CLAIMED IS:

1. A communication system comprising:

5 a signal transmitting device having

a sending CPU and a sending memory;

5 a generated signal template for generating a  
signal pattern to be transmitted;

a signal display for displaying the signal pattern  
generated by said generated signal template;

a signal display controller for controlling position and  
orientation of said signal display;

a signal receiving device for communicating with said signal  
transmitting device having

a receiving memory and a receiving CPU;

15 a visual recording device for sensing the signal pattern  
of the signal display;

an image decoder for decoding the signal pattern; and

a visual recording device controller for automatically  
controlling the orientation and zoom of said visual recording  
device, wherein communication between said signal

20 transmitting device and said signal receiving device is  
established by the visual recording device detecting and  
decoding visual images displayed by the signal display.

2. The system of claim 1, wherein a plurality of mirrors are used to transmit signal patterns between a signal transmitting device and a signal receiving device having obstructions between them.

5 3. A method of visual communication between a signal transmitting device and a signal receiving device comprising the steps of:

adjusting a signal display of said signal transmitting device and a visual recording device of said signal receiving device and using an alternating display process to establish a visual connection between said signal display and said visual recording device;

encoding a signal pattern using a generated signal template of said signal transmitting device;

15 visually transmitting the signal pattern through free space from the signal display of said signal transmitting device;

receiving an image of the signal pattern using the visual recording device of said signal receiving device; and

20 decoding the signal pattern using an image decoder of the signal receiving device.

4. The method of claim 3, wherein the step of decoding includes the steps of:

dividing the image of the signal pattern into a plurality of blocks;

5 determining the centers of said blocks using a position and radius look-up table;

creating a plurality of circles within said blocks having corresponding centers and radiuses determined by the position and radius look-up table;

10 calculating average image intensities within said circles;

using average image intensities within said circles as average image intensities of respective blocks of each of said circles;

15 determining a plurality of black and white intensities from said average intensities of respective blocks of each of said circles using predetermined values; and

20 decoding a pattern created by said black and white intensities.

5. The method of claim 3, wherein the alternating display process comprises the steps of:

alternating an image on the signal display of a  
sending device within an allotted time;

collecting a plurality of alternating images by a  
visual recording device of a receiving device within an  
allotted time;

calculating image differences of consecutive  
alternating images;

changing said image differences into black and  
white images based on pixel values; and

collecting a plurality of blobs for each of said  
image differences using the visual recording device, wherein  
the blob having a largest area value represents the signal  
display.

6. The method of claim 3 wherein the step of adjusting the  
visual recording device includes the steps of:

automatically adjusting pan and tilt of the visual  
recording device; and

automatically adjusting an angle size of the  
recording device.

7. The method of claim 4, wherein the radiuses of said  
circles are 35% of the length of their respective blocks.

8. The method of claim 5, wherein the blobs are groups of adjoining pixels each having an identical pixel value.

9. The method of claim 6, wherein the step of automatically adjusting the pan and tilt for a visual recording device comprises the steps of:

selecting a first tilt and a first pan position;  
panning for a position that does not overlap said first pan position;

checking if panning positions have been exhausted;  
determining whether the first tilt is in a horizontal position if all panning positions have been exhausted; and

determining a new tilt by moving the first tilt upwards for the value of  $h/2$  if the first tilt is in a horizontal position.

10. The method of claim 9, wherein if all panning positions have not been exhausted, the step of panning for a position that does not overlap the first pan position is repeated.

11. The method of claim 9, wherein if the first tilt is above the horizontal position, the new tilt will be below the horizontal position and symmetric to the first tilt.

12. The method of claim 9, wherein if the first tilt is below the horizontal position, including the steps of:

determining that the first tilt is not above the horizontal position;

finding a previous tilt that is symmetric to the first tilt and is above the horizontal position;

creating a possible tilt by moving the first tilt upwards for  $h/2$  with respect to said previous tilt; and

determining if said possible tilt passes a vertical direction with respect to the horizontal position.

13. The method of claim 12, wherein if said possible tilt passes the vertical position, then all tilts are exhausted.

14. The method of claim 12, wherein if said possible tilt does not pass the vertical position, then said possible tilt is a next tilt.

15. A program storage device readable by machine, tangibly embodying a program of instructions executable by machine to perform method steps for communication between processing devices comprising the steps of:

5           generating a signal pattern using a generated signal template;  
          displaying the signal pattern on a signal display;  
          adjusting a visual recording device and said signal display and using an alternating display process to establish  
10           a visual connection between the processing devices;  
          acquiring an image of the signal pattern using the visual recording device; and  
          decoding the signal pattern with an image decoder.

16. The program storage device of claim 15, wherein the instructions for decoding includes instructions for:

15           dividing the image of the signal pattern into a plurality of blocks;  
          determining the centers of said blocks using a position and radius look-up table;  
20           creating a plurality of circles within said blocks having corresponding centers and radiuses determined by the position and radius look-up table;





image differences with the visual recording device, wherein the blob having a largest area value represents the signal display.

18. The program storage device of claim 15, wherein the instructions for performing the step of adjusting the visual recording device and said signal display includes instructions for:

automatically adjusting the pan and tilt of the visual recording device; and

automatically adjusting the angle size of the recording device.

19. The program storage device of claim 16, wherein the radiuses of said circles are 35% of the length of their respective blocks.

20. The program storage device of claim 17, wherein the blobs are groups of adjoining pixels each having an identical pixel value.

21. The program storage device of claim 18, wherein the instructions for performing the step of automatically

adjusting the pan and tilt for a visual recording device  
includes instructions for performing the steps of:

selecting a first tilt and a first pan position;  
panning for a position that does not overlap said  
5 first pan position;  
checking if panning positions have been exhausted;  
determining whether the first tilt is in a  
horizontal position if all panning positions have been  
exhausted; and  
10 determining a new tilt by moving the first tilt  
upwards for the value of  $h/2$  if the first tilt is in a  
horizontal position.

22. The program storage device of claim 21, wherein if all  
panning positions have not been exhausted, the instructions  
15 for performing the step of panning for a position that does  
not overlap the first pan position are repeated.

23. The program storage device of claim 21, wherein if the  
first tilt is above the horizontal position, the new tilt  
will be below the horizontal position and symmetric to the  
20 first tilt.

